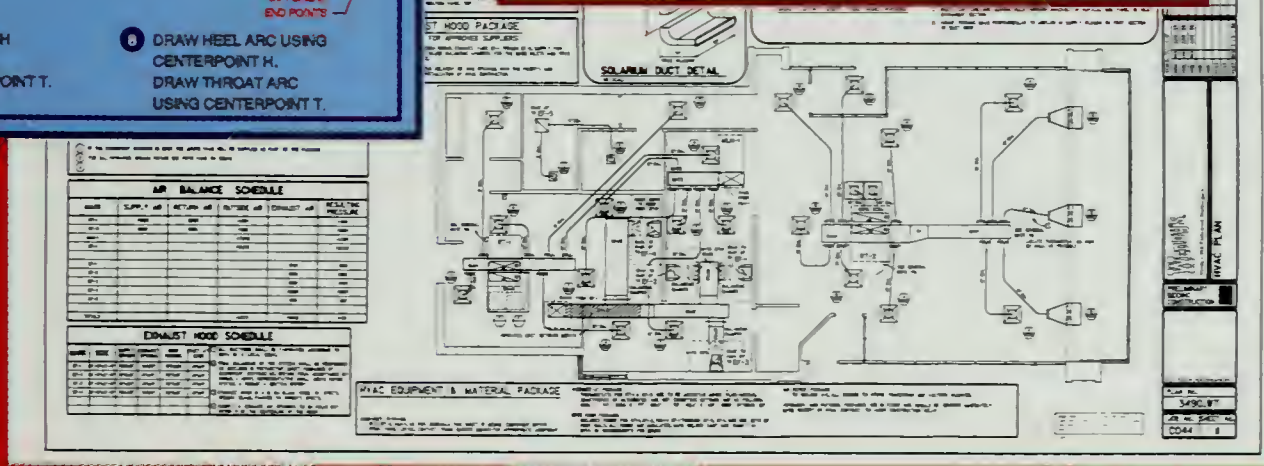
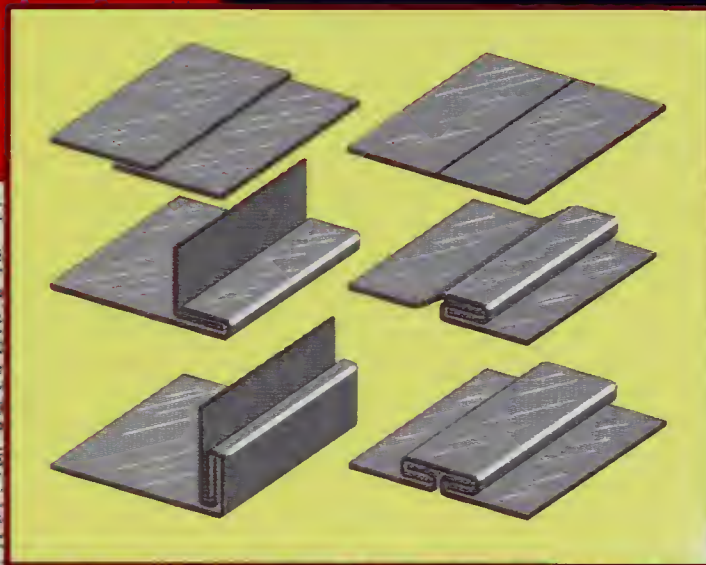


TRANSITION IN HEEL AND THROAT SLANTED CHEEK LAYOUT




R. T. Miller

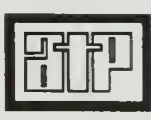


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SHEET METAL Workbook

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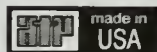
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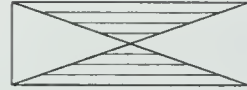
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Introduction



Sheet Metal Workbook provides tests based on the content of *Sheet Metal*. The tests in *Sheet Metal Workbook* correlate with each chapter in *Sheet Metal*. The corresponding chapter of *Sheet Metal* should be studied before taking the tests. Particular attention should be paid to illustrations and major terms.

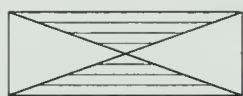
Test questions include completion, multiple choice, true-false, and matching. Always record answers in the space(s) provided. All answers are given in the *Sheet Metal Workbook Instructor's Guide*.

The Publisher

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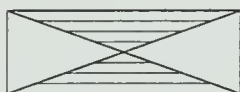
TEST 1

Name _____ Date _____

Opportunities Unlimited

- T F 1. Sheet metal workers that are highly skilled at several tasks are known as apprentices.
- T F 2. Precision sheet metal workers commonly fabricate and install gutters, sheet metal roofs, and louvers on new buildings.
- T F 3. Apprenticeship programs for sheet metal workers last about four to five years.
- _____ 4. A(n) _____ tests newly-installed HVAC systems for proper air flow.
A. sign worker C. energy management technician
B. sheet metal contractor D. testing, adjusting, and balancing technician
- _____ 5. A(n) _____ worker commonly works on an assembly line with highly specialized operations.
A. precision sheet metal C. sheet metal layout
B. production sheet metal D. outside sheet metal
- _____ 6. A _____ determines the cost of a job based on the time and materials required.
A. salesperson C. sheet metal estimator
B. sheet metal contractor D. welder
- T F 7. Generally, apprentice wages begin at approximately 70% of journeyman wages.
- T F 8. The Joint Apprenticeship and Training Committee determines the number of apprentices employed by a particular shop.
- _____ 9. The Joint Apprenticeship and Training Committee is composed of _____.
A. apprentices C. journeyman sheet metal workers
B. sheet metal employers D. sheet metal workers and employers
- T F 10. A variety of career options are available in the sheet metal trade.
- T F 11. Sheet metal fabrication involves cutting and shaping operations.
- T F 12. Sheet metal is trimmed with squaring shears.
- _____ 13. Sheet metal workers can remain current in the field by _____.
A. reading trade publications C. attending classes and seminars
B. participating in professional or trade organizations D. A, B, and C
- T F 14. An apprenticeship agreement is a document of agreement between the apprentice and the Joint Apprenticeship and Training Committee.
- _____ 15. The term, sheet metal, generally applies to metals and alloys ranging in thickness up to _____ gauge.
A. 6 C. 26
B. 10 D. 32

- _____ 16. A sheet metal _____ is often the same person who lays out the patterns.
- _____ 17. A(n) _____ sheet metal worker installs custom-designed skylights, cornices, and other building components.
- _____ 18. A(n) _____ is a piece of equipment used to make seams in sheet metal.
- _____ 19. A(n) _____ worker works with letter and logo designs used on commercial buildings.
- _____ 20. _____ is the process of determining how a flat piece of sheet metal is formed into a finished article.
 A. Assembly C. Fabrication
 B. Installation D. Planning and layout
- _____ 21. A(n) _____ installs, services, and repairs HVAC equipment and controls.
 A. HVAC service technician C. sheet metal contractor
 B. outside sheet metal worker D. A, B, and C
- _____ 22. Sheet metal fabrication involves _____.
 A. pattern development C. cutting, forming, and grooving
 B. estimating D. damper balancing
- T F 23. A decking and siding worker may install metal studs, rafters, and framing members.
- T F 24. Stainless steel workers work with equipment used in the food service industry.
- T F 25. Greater job security is possible by acquiring more job skills.
- _____ 26. _____ are installed by the outside sheet metal worker.
 A. Louvers C. Flashing
 B. Gutters D. A, B, and C
- T F 27. A welder permanently joins sheet metal components.
- _____ 28. _____ is training required in the apprenticeship away from the job site.
- _____ 29. A(n) _____ produces sheet metal components in a production setting.
- _____ 30. A(n) _____ is equipment used to form bends and edges in sheet metal.
- _____ 31. A(n) _____ commonly takes samples of air in buildings to detect the presence of toxic gases.
 A. sheet metal layout person C. outside sheet metal worker
 B. indoor air quality technician D. HVAC service technician
- _____ 32. A(n) _____ technician surveys buildings for energy consumption.
 A. HVAC service C. sheet metal fabrication
 B. indoor air quality D. neither A, B, nor C
- _____ 33. A(n) _____ owns and manages a sheet metal shop.
- _____ 34. A(n) _____ technician measures air flow at each outlet and adjusts dampers to specifications.
- _____ 35. At the end of 3½ years, the apprentice receives approximately 80% to 90% of _____ wages.



TEST 2

Name _____ Date _____

Sheet Metal Working Tools and Machinery

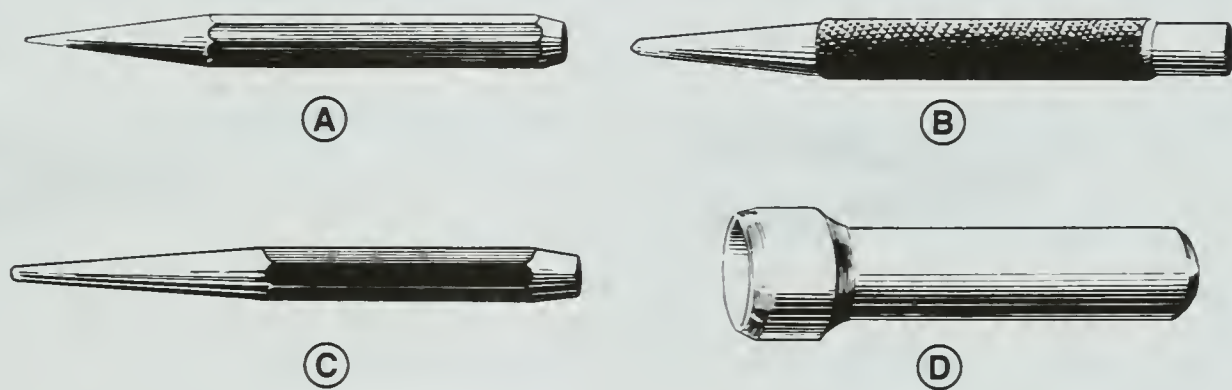
- T F 1. The ring scratch awl has a replaceable wooden handle.
- T F 2. The long arm of the steel square is the tongue.
- T F 3. Numbers on the bottom edge of a steel circumference rule are used for finding the circumference of a circle or cylinder.
- _____ 4. Sheet metal workers commonly use a _____ scratch awl for general purpose work.
A. ring C. shank
B. socket D. carbide tipped
- _____ 5. Large circles are best drawn with _____.
A. a circumference rule C. a steel square
B. dividers D. trammel points
- T F 6. Prick punches have a point that is tapered to a 90° included angle.
- T F 7. Solid punches are used to punch small holes in sheet metal.
- _____ 8. A _____ punch is used for marking centers of holes to be drilled.
A. prick C. solid
B. center D. hollow
- T F 9. A rivet set is used to remove rivets installed from the top side of the part.
- _____ 10. A(n) _____ is used for cutting bolts.
- _____ 11. A flat cold chisel is ground to a _____° included angle.
A. 50 C. 70
B. 60 D. 90
- _____ 12. A _____ is used to cut V-shaped grooves.
A. cape C. diamond point
B. round nose D. neither A, B, nor C
- T F 13. Keyways are cut with a diamond point chisel.
- _____ 14. A _____ hammer has a claw on the end of the head.
A. nail C. ball peen
B. riveting D. raising
- T F 15. A riveting hammer has a square flat face and a single tapered peen.
- _____ 16. _____ are used when steel hammers would damage the work.

- _____ 17. _____ snips are designed for cutting inside circles.
A. Bulldog C. Double-cutting
B. Circular D. Hawk bill
- _____ 18. _____ pliers have an adjustable jaw.
A. Flat-nose C. Slip-joint combination
B. Round-nose D. A, B, and C
- _____ 19. _____ snips have short blades and long handles to provide increased leverage when cutting thick metals.
- T F 20. Aviation snips use compound leverage to cut thick sheet metal easily.
- _____ 21. General soldering is performed with _____ soldering copper.
A. square pointed C. tapered
B. bottom D. roofing
- _____ 22. A _____ file is commonly used for finish filing.
A. flat C. round
B. mill D. half-round
- _____ 23. The _____ of a file inserts into a file handle.
A. heel C. point
B. face D. tang
- _____ 24. _____ files have two sets of teeth crossing each other.
- T F 25. The length of a file is measured from the point to the end of the tang.
- _____ 26. The principal parts of a stake are the _____.
A. shank, head, and horn C. shank, head, and heel
B. shank, head, and edge D. tang, heel, and head
- T F 27. Blowhorn stakes are used for forming, riveting, or seaming long tapered articles.
- _____ 28. A _____ stake is commonly used for forming boxes by hand.
A. breakhorn C. hatchet
B. creasing D. bottom
- _____ 29. A _____ is used when forming sheet metal over stakes.
A. mallet C. setting hammer
B. raising hammer D. hand dolly
- T F 30. Stake shanks have a standard size.
- _____ 31. A turning machine produces _____.
A. sharp edges C. double seams
B. rounded edges D. A, B, and C
- _____ 32. A(n) _____ machine is used when seaming containers of various shapes.
A. crimping C. setting-down
B. edging D. wiring
- _____ 33. Metal disks for the bottoms of cans are cut on _____.
A. rotary circular shears C. slip-roll forming machines
B. beading machines D. grooving machines

- _____ 34. _____ stakes have flat, convex, and concave surfaces.
- T F 35. Universal stakeholders do not require a bench plate.
- _____ 36. The _____ machine is used for crimping small ends of pipes and flanges.
- T F 37. A wiring machine is used for double-seam flat bottoms.
- T F 38. A beading machine uses ogee rolls for beading operations.
- _____ 39. Press brakes shape sheet metal with _____.
 A. rollers C. dies
 B. shears D. grooved beads
- T F 40. A slip-roll forming machine is used to form cylindrically shaped objects and pipe.
- T F 41. A grooving machine is used for grooving longitudinal seams in cylinders.
- T F 42. The pan brake has removable sections in the upper blade.

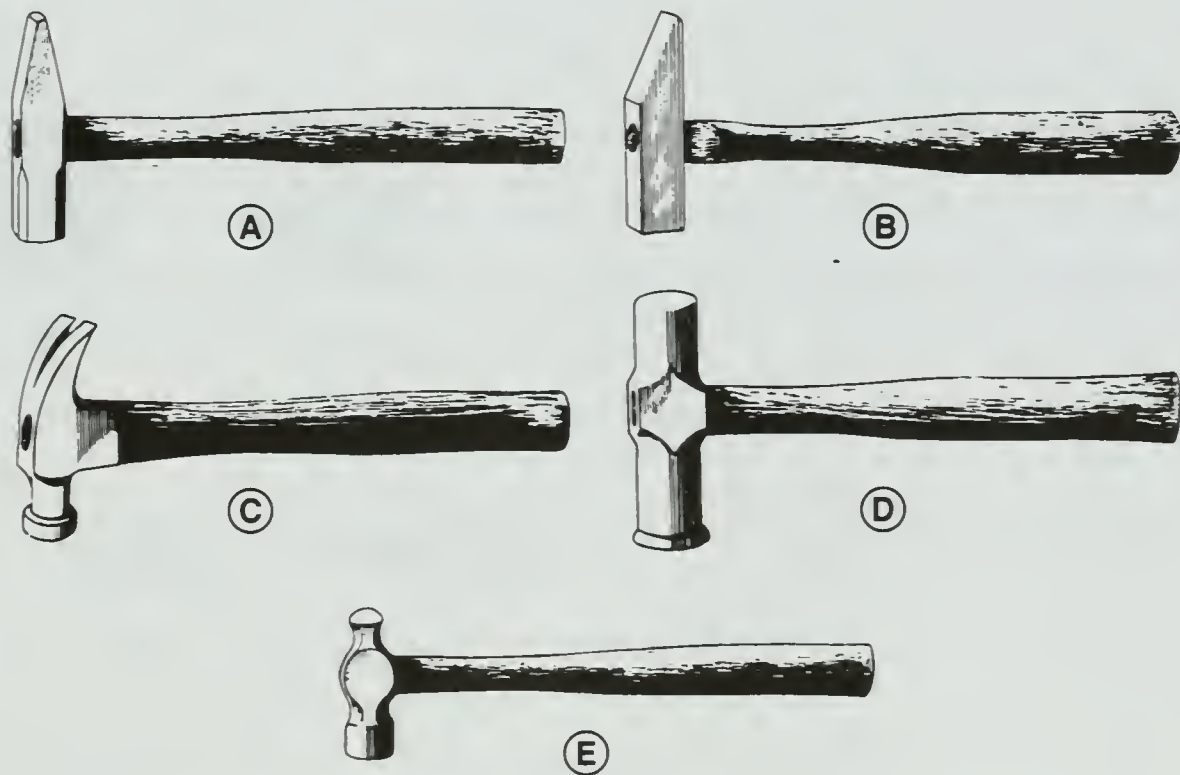
Matching - Punches

- _____ 1. Center
- _____ 2. Hollow
- _____ 3. Prick
- _____ 4. Solid



Matching - Hammers

- _____ 1. Setting
- _____ 2. Raising
- _____ 3. Nail
- _____ 4. Ball peen
- _____ 5. Riveting

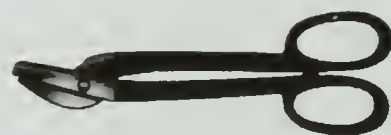


Matching – Snips

- _____ 1. Right hand aviation
- _____ 2. Double cutting
- _____ 3. Left hand aviation
- _____ 4. Combination blade
- _____ 5. Straight aviation
- _____ 6. Bench
- _____ 7. Bulldog
- _____ 8. Circular



(A)



(B)



(C)



(D)



(E)



(F)



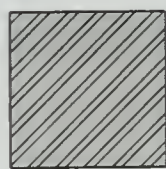
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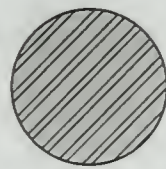
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Matching – Files

- _____ 1. Flat
- _____ 2. Mill
- _____ 3. Knife
- _____ 4. Three Square
- _____ 5. Square
- _____ 6. Round
- _____ 7. Half Round



(A)



(B)



(C)



(D)



(E)



(F)



(G)



TEST 3

Name _____ Date _____

Safety in the Sheet Metal Shop

- _____ 1. Sheet metals containing _____ give off toxic fumes when welded.
A. zinc C. brass
B. cadmium D. A, B, and C
- _____ 2. For safety when welding, _____ should not be worn.
A. leather gloves C. high-topped shoes
B. cuffed pants D. A, B, and C
- T F 3. A sharp tool is safer than a dull tool.
- T F 4. All injuries must be reported immediately.
- T F 5. Industrial eye injuries account for up to 5% of all worker's compensation cases.
- T F 6. Heavy loads should be lifted using leg muscles to prevent back injury.
- _____ 7. Fumes from _____ when soldering can be harmful.
A. solder C. flux
B. steel D. neither A, B, nor C
- T F 8. Mushroomed heads on chisels should be removed to prevent injury.
- T F 9. Always push when using a wrench.
- _____ 10. A hammer should never be used on _____ surfaces.
A. brass C. lead
B. bronze D. hardened
- _____ 11. Oily rags improperly stored are subject to _____ combustion.
A. spontaneous C. ignition
B. gaseous D. neither A, B, nor C
- T F 12. Workers should stay clear of the counterbalance balls when working near a hand brake.
- T F 13. Rod and wire are bent using a sheet metal brake.
- T F 14. The safest method of testing a soldering copper for correct heat is to apply the copper to the solder.
- T F 15. Small, curved slivers of metal left on the edges of sheet metal after cutting are called fish hooks.
- T F 16. Proper eye protection is required for all types of welding.
- _____ 17. Squaring shears are designed to be operated _____.
A. as quickly as possible C. with metal fed from the back
B. by one person D. neither A, B, nor C

- T F 18. Power tools are grounded to prevent injury from electrical shock.
- _____ 19. Power tools should never be used _____.
A. without eye protection C. in wet or damp locations
B. without proper grounding D. A. B. and C
- T F 20. OSHA regulations prohibit unprotected workers in areas where noise levels can cause injury.
- T F 21. Neatness and efficiency of work areas is the responsibility of all workers.
- T F 22. Wearing eye protection when arc welding protects against injury from ultra-violet and infra-red rays.
- T F 23. Adjustments to power tools should be made with the power disconnected.
- T F 24. A mechanical exhaust system is required when welding metals containing zinc and brass.
- T F 25. Small sheet metal pieces should be held from behind the blade of the squaring shears to prevent injury.
- _____ 26. Molten _____ will spatter if dropped on a cold or moist surface.
- _____ 27. _____ cylinders and hoses should not be exposed to sparks or excessive heat.
- _____ 28. Make sure all valves are in _____ position before attempting to light any gas appliance.
- _____ 29. Make sure that _____ are thrown in a safe direction when grinding or sanding.
- _____ 30. _____ will follow the easiest path into the ground.
- T F 31. Power cords should be properly grounded.
- _____ 32. If adequate ventilation cannot be provided when welding, the operator should wear a _____.
A. face mask C. both A and B
B. respirator D. neither A nor B
- T F 33. A 115 volt power tool can produce a shock that kills.
- _____ 34. Ultra-violet and infra-red rays produced when arc welding are dangerous at distances up to _____'.
- T F 35. Heat can cause concrete to explode with sufficient force to injure personnel.
- _____ 36. OSHA requires that employees be exposed to no more than _____ decibels of steady-state or interrupted noise levels during their eight hour working day.
- _____ 37. Nearly _____ workers' deaths occur off the job.
A. 2 out of 10 C. 2 out of 100
B. 7 out of 10 D. 7 out of 100



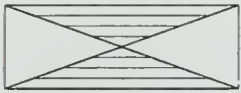
TEST 4

Name _____ Date _____

Sheet Metal Types

- T F 1. Sheet steel is available as coated or uncoated.
- T F 2. A digital micrometer indicates the measurement on the barrel and thimble, and the digital readout.
- _____ 3. The _____ gage system is commonly used for sheet steel.
A. U.S. Wire C. Manufacturers' Standard for Steel Sheet
B. Brown and Sharpe D. plate thickness
- _____ 4. Sixteen gage sheet steel is _____ as thick as 22 gage sheet metal.
A. half C. three times
B. twice D. neither A, B, and C
- _____ 5. _____ is one of the oldest sheet metals and is gaged in pounds per square foot.
- _____ 6. _____ metals are those metals that contain no iron or steel.
- _____ 7. Of all sheet metals, _____ sheet metal is the least expensive.
- T F 8. Galvanized sheet metal is available in 18" and 54" widths.
- T F 9. Air conditioning ductwork is commonly fabricated from aluminum.
- T F 10. Galvanized sheet metal produces toxic fumes when welded.
- _____ 11. A square foot of 14 gage sheet metal weighs approximately _____ lb.
A. .6250 C. 1.1254
B. 1.052 D. 3.1250
- _____ 12. A sheet of 16 gage steel (U.S. Standard Gage) is _____" thick.
A. $\frac{1}{8}$ C. $\frac{3}{8}$
B. $\frac{3}{16}$ D. neither A, B, nor C
- T F 13. A common type of stainless steel used for food service equipment is 302.
- _____ 14. As the gage number of sheet metal increases, the thickness _____.
A. increases C. stays the same
B. decreases D. A, B, and C
- T F 15. Aluminum is heavier than stainless steel.
- T F 16. Copper is commonly used for architectural sheet metal work.
- _____ 17. Each line on the barrel of a micrometer represents _____.
A. .025 C. .265
B. .250 D. .275

- _____ 18. Galvanized sheet metal is steel-coated with _____.
A. copper C. tin
B. zinc D. lead and tin
- _____ 19. Galvanized sheet metal is widely used because it is economical and _____.
A. lighter than aluminum C. has good corrosion resistance
B. made of nickel D. A, B, and C
- _____ 20. Stainless steel commonly contains 10%-25% nickel and _____ chromium.
A. 5%-10% C. 10%-30%
B. 10%-20% D. 30%-40%
- T F 21. Lead is commonly used as a shield from X-rays.
- _____ 22. The finish most commonly used on stainless steel is number _____.
A. 2 C. 5
B. 3 D. 7
- _____ 23. _____ is widely used for fabrication of food service equipment and furniture.
A. Galvanized sheet metal C. Stainless steel
B. Copper D. Tin plate steel
- _____ 24. Tin plate is steel coated with _____.
A. pure tin C. zinc and tin
B. tin and antimony D. neither A, B, nor C
- _____ 25. The material most commonly used in a sheet metal shop is _____.
A. copper C. lead
B. steel D. zinc
- _____ 26. Hot-rolled copper _____ when formed.
A. softens C. anneals
B. work-hardens D. A, B, and C
- T F 27. Rust forming on steel is iron oxide.
- _____ 28. Sheet aluminum is commonly alloyed with _____.
A. copper C. chromium
B. magnesium D. A, B, and C
- _____ 29. Aluminum sheet thickness is specified using _____.
A. the U.S. Standard C. the Brown and Sharpe Gage
B. decimals of an inch D. neither A, B, nor C
- _____ 30. Metal, when exposed to oxygen in the air, forms _____.
A. zinc C. oxides
B. bronze alloys D. A, B, and C



TEST 5

Name _____ Date _____

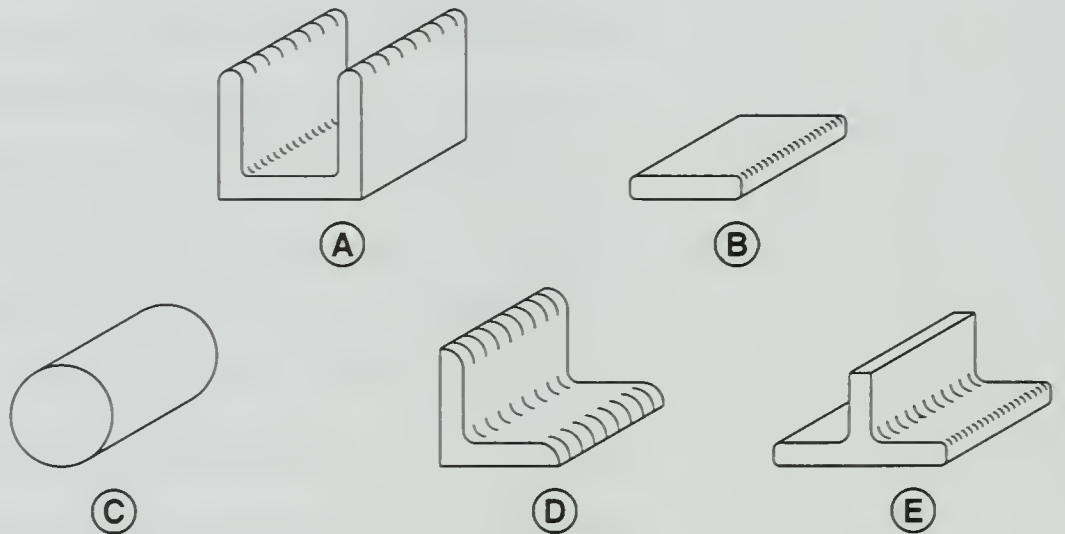
Materials of the Sheet Metal Trade

- T F 1. Rod is mild steel bar with a diameter of $\frac{1}{2}$ " or less.
_____ 2. _____ are installed in ducts to regulate the flow of air.
A. Bars C. Rods
B. Registers D. Dampers
- _____ 3. Pipe used in the sheet metal trade ranges from $\frac{3}{8}$ " to _____" in diameter.
A. $\frac{7}{8}$ C. $1\frac{1}{8}$
B. 1 D. $1\frac{1}{4}$
- _____ 4. Steel wire is commonly coated with _____ to prevent rust and corrosion.
A. zinc C. copper
B. tin D. A, B, and C
- T F 5. Angle steel is specified by the width of each side and the thickness of the metal.
T F 6. Flat bar is commonly used to suspend air conditioning duct.
T F 7. Channel steel is used in place of angle steel when additional stiffness is required.
T F 8. Hot-rolled steel is harder than cold-rolled steel and has a rougher surface.
- _____ 9. Copper tube is measured by its _____ diameter.
_____ 10. _____ is used to provide a stiff edge on the top edge of a sink.
- T F 11. Wire cloth with $\frac{1}{8}$ " to $\frac{1}{2}$ " squares is called hardware cloth.
T F 12. Mesh refers to the number of openings per square inch in the screen.
- _____ 13. Wire cloth is made from _____.
A. brass C. copper
B. galvanized steel D. A, B, and C
- T F 14. Expanded metal is metal that is cut and stretched across its width.
T F 15. Perforated metal is sometimes called cane metal.
T F 16. Pipe sizes are commonly specified by outside diameter.
T F 17. Copper tubing is commonly connected using brass fittings.
- _____ 18. _____ metal is stiffer than hardware cloth, and is used as a security closure over large openings.
T F 19. Grills have movable bars that direct the flow of air.

- | | | | |
|---|---|-------|--|
| T | F | 20. | Tee bar is specified by width, height, and thickness. |
| T | F | 21. | Wire is commonly shipped in 500 lb rolls. |
| T | F | 22. | Angle steel is commonly used for stiffeners around the top of sheet metal boxes. |
| | | _____ | 23. Cane metal restricts the flow of air more than _____. |
| | | | A. expanded metal C. hardware cloth |
| | | | B. grills D. A, B, and C |
| T | F | 24. | Flat bar is specified by width and thickness. |
| T | F | 25. | Installation of pipe is a common task of a sheet metal worker. |
| | | _____ | 26. _____ are used on duct openings where direction of air flow is not required. |
| | | _____ | 27. _____ is a mild steel shape that is specified by diameter and length. |
| T | F | 28. | Hot-rolled steel shapes require galvanizing for a smoother finish. |
| T | F | 29. | Large dampers that are ready to install in the duct are purchased from the manufacturer. |
| T | F | 30. | Steel wire is stronger than copper wire. |

Matching – Mild Steel Shapes

- _____ 1. Round bar
- _____ 2. Angle
- _____ 3. Channel
- _____ 4. Flat bar
- _____ 5. T-bar





TEST 6

Name _____ Date _____

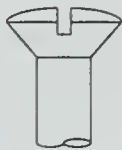
Fasteners for Sheet Metal

- T F 1. A 2 lb tinner's rivet means that approximately 1000 rivets weigh 2 lb.
- T F 2. Tinner's rivets have a flat head.
- T F 3. Blind rivets are installed from one side of the work.
- T F 4. Thread designations for bolts and machine screws are Unified National Coarse and Unified National Fine.
- _____ 5. _____ rivets are hollow rivets in which the mandrel is broken during installation.
A. Standard C. Expansion
B. Tinner's D. Blind
- _____ 6. A number 12 UNC bolt has _____ threads per inch.
A. 14 C. 32
B. 24 D. neither A, B, nor C
- T F 7. A 10-24 machine screw has 10 threads per inch.
- _____ 8. Sheet metal screws are classified by type of point and _____.
- _____ 9. _____ screws make their own mating threads while being driven into material.
A. Machine C. Toggle
B. Self-tapping D. Stove
- _____ 10. Drive screws are driven with a(n) _____.
- T F 11. Lag screws are large wood screws with slotted heads.
- T F 12. Plastic anchors are used for heavy loads.
- _____ 13. _____ are used to fasten material to a hollow wall.
A. Toggle bolts C. both A and B
B. Hollow wall screw anchors D. neither A, B, nor C
- _____ 14. _____ joins metal without melting the parent metal.
A. Soldering C. both A and B
B. Brazing D. neither A or B
- T F 15. Self-drilling screws require a hole drilled prior to installation.
- _____ 16. Powder-actuated fasteners commonly use _____ caliber cartridges.
- T F 17. Oxy-acetylene welding equipment can be used for brazing.
- T F 18. Inert gas welding produces more heat than arc welding.

- _____ 19. _____ welding passes electric current through the welded metal to create heat.
- T F 20. Rivets are commonly made of steel, copper, brass, and aluminum.
- _____ 21. _____ welding joins metal by passing electricity through roller electrodes.
- T F 22. The welding rod is fed automatically when oxy-acetylene welding.
- _____ 23. Inert gas welding produces a stronger weld with less warpage than _____ welding.
- T F 24. Oxy-acetylene welding is sometimes called gas welding.
- T F 25. Lag bolts are used in heavy construction applications with machine expansion shields.

Matching – Screw Heads

- _____ 1. Flat
- _____ 2. Oval
- _____ 3. Round
- _____ 4. Fillister



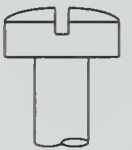
(A)



(B)



(C)



(D)

Matching – Rivets

- _____ 1. Countersunk head
- _____ 2. Truss head
- _____ 3. Flat head
- _____ 4. Button head
- _____ 5. Pan Head



(A)



(B)



(C)



(D)



(E)



TEST 7

Name _____ Date _____

Using Patterns and Cutting Metal

- T F 1. A pictorial drawing shows the object after being formed.
- T F 2. Notching and clipping remove portions of the metal to prevent overlapping and bulging on seams and edges.
- _____ 3. The distance across the flat pattern or flat piece of metal before it is formed is a _____.
A. brake C. mechanical
B. stretchout D. A, B, and C
- T F 4. The location of brake lines on metal patterns are marked by prick punching.
- T F 5. Four methods of layout are simple pattern layout, parallel line development, radial line development, and triangulation.
- T F 6. To avoid overcutting when notching, the end of the blades are positioned at the end of the notch.
- _____ 7. A(n) _____ is used to crimp the small ends of pipe after cutting.
- _____ 8. _____ refers to the method of developing the lines which form the pattern.
- _____ 9. The _____ on the aviation snips should be oiled occasionally to assure proper operation.
A. blades C. swivel bolt
B. handle D. A, B, and C
- _____ 10. Stack sawing on a _____ saw can be used to increase production.
A. band C. hack
B. hand D. compound
- T F 11. The circumference of a pipe is determined by multiplying 3.14 times the diameter.
- T F 12. Squaring shears are used to obtain a square end on the sheet.
- T F 13. A paper pattern is best used by prick punching the ends of lines through the paper.
- _____ 14. A(n) _____ uses gas directed through an electric arc to rapidly cut sheet metal.
A. inert gas cutter C. oxy-acetylene torch
B. plasma cutter D. A, B, and C
- _____ 15. Pipe is cut using _____ shears.
A. circular C. bulldog snip
B. bench D. double-cutting
- T F 16. A sharp scratch awl is commonly used to trace the outline of a metal pattern.
- T F 17. Large curves can be drawn by bending a 3' circumference rule.

- _____ 18. X symbols on a pattern indicate where the sheet metal is to be _____.

_____ 19. In most cases, only _____ views are required to show the shape and size of the object.

T F 20. Steel sheets are squared at all corners before leaving the factory.

_____ 21. _____ cut sheet metal by rapidly punching a small hole with each stroke.
A. Band saws C. Squaring shears
B. Power hand shears D. Nibblers

_____ 22. The most commonly used snips in a sheet metal shop are _____ snips.
A. bulldog C. aviation
B. combination D. A, B, and C

_____ 23. Patterns that are used repeatedly are called _____.
A. layouts C. stretchouts
B. templates D. elevations

_____ 24. _____ are heavy duty shears designed to cut up to $\frac{3}{16}$ ".

T F 25. Combination snips are commonly used for cutting 24 gage or thinner sheet metal.

_____ 26. Right-hand and left-hand _____ snips are used to cut a square hole accurately.

T F 27. Cutting wire with snips will damage the blades.

_____ 28. The pattern is cut to within _____" of final size to allow scrap metal to curl out of the way easily when making the final cut.

T F 29. Some band saws are equipped with a built-in blade welder.

T F 30. The squaring shears may be used to cut more than one sheet for production efficiency.

T F 31. Power hand shears are used only to cut curved lines.

T F 32. Some power hand shears can cut up to 12 gage sheet metal.

T F 33. The point of a prick punch will become dull if used on an iron surface.

T F 34. Both feet are used when cutting sheet metal on the squaring shears.

_____ 35. Rules for sheet metal are not divided into less than _____".



TEST 8

Name _____ Date _____

Punching, Drilling and Riveting

- _____ 1. The _____ is a principal part of a twist drill.
A. body C. shank
B. point D. A, B, and C
- T F 2. Rivet holes near the edges are usually drilled in light sheet metal.
- T F 3. When drilling a hole in sheet metal, the prick punch mark is enlarged with a center punch.
- T F 4. Turret punches are used for punching holes from $\frac{1}{8}$ " to 2".
- _____ 5. _____ is placed behind the sheet metal for support when using a solid punch.
- _____ 6. Longitudinal seams require different rivet spacing than _____ seams.
- T F 7. Button punching provides a series of small holes through the sheet metal.
- T F 8. The die on a hand lever punch is adjusted until the punch barely punches a clean hole.
- _____ 9. A _____ is used to make an indentation for centering the drill.
A. center punch C. prick punch
B. scratch awl D. neither A, B, nor C
- _____ 10. The end of the rivet that is upset is referred to as the _____ or upset head.
A. round C. flattened
B. countersunk D. formed
- T F 11. A solid punch is sometimes used to make rivet holes and starter holes for sheet metal screws.
- T F 12. Work on a drill press should be properly mounted in a vise or held by a C clamp.
- T F 13. Tinner's rivets are sized by their head diameter.
- T F 14. The minimum space between the center of the rivet and the edge of the metal is $1\frac{1}{2}$ times the diameter of the rivet.
- _____ 15. A _____ punch is used to remove rivets in light gage sheet metal.
A. center C. solid
B. hollow D. A, B, and C
- _____ 16. _____ rivets have heads that are flat and flush with the metal after installation.
A. Roundhead C. Tinnners'
B. Countersunk D. Flat
- _____ 17. When riveting a seam, the two _____ rivets are set first.
- T F 18. Holes for rivets should be slightly smaller than the shank diameter of the rivet.

- T F 19. The length of a tinner's rivet includes the thickness of the head.

_____ 20. A _____ rivet is used when exceptional strength is required.
A. Roundhead C. Tinner's
B. Countersunk D. Flat

T F 21. The rivet shank should protrude through the pieces being joined at least one to two times the diameter of the rivet before forming with the rivet set.

T F 22. Minimum distance between rivets in a line should be about three times the rivet diameter.

_____ 23. Working from the _____ to the end of a pipe can remove bulges caused by misalignment of holes.

_____ 24. Centers of holes are marked first with a(n) _____ punch.

T F 25. Riveting a seam on round pipe is best completed on a stake.

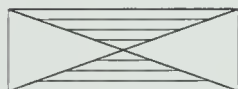
T F 26. Twist drills are used as the cutting tool when drilling holes.

_____ 27. A rivet set contains a deep hole and a shallow _____ hole.
A. convex C. countersunk
B. concave D. tapered

_____ 28. A _____ punch is used to punch holes in sheet metal by hand.
A. turret C. drill
B. hand lever D. neither A, B, nor C

_____ 29. The _____ of the rivet required is determined by the thickness of the sheets joined.
A. length C. head type
B. shank taper D. A, B, and C

_____ 30. Twist drill sizes may be specified by _____.
A. fraction C. letter
B. number D. A, B, and C



TEST 9

Name _____ Date _____

Folding Edges and Making Seams

- T F 1. A double hem requires two folding operations.
- T F 2. The width of the bend is limited in a bar folder.
- _____ 3. Allowance for metal thickness is not required when making seams of _____ gage or lighter on a bar folder.
- _____ 4. The seam used is determined by the _____.
A. metal thickness C. fabrication cost
B. metal type D. A, B, and C
- _____ 5. The three basic parts of the brake are the top leaf, the bending leaf, and the _____.
_____ 6. The _____ seam is sometimes called a hammer lock and is used as a longitudinal corner seam.
- _____ 7. A(n) _____ seam eliminates the need for angle steel reinforcement.
- _____ 8. A(n) _____ edge is used to cover nail heads and edges of sheet metal.
- _____ 9. A(n) _____ hem is a folded edge used to increase the strength and make a smooth finished edge.
- T F 10. A brake should be bolted to the floor to prevent movement.
- T F 11. The brake requires no adjustment for different thicknesses of metal.
- _____ 12. The capped edge is approximately _____" on each side.
- _____ 13. A(n) _____ is generally used in connection with S clips for connecting cross seams on ducts.
- _____ 14. A(n) _____ seam has a bead formed around one end of the cylinder.
- _____ 15. The most common seam used in the sheet metal shop is the _____ seam.
A. drive-clip C. Pittsburgh
B. slip-joint D. handy
- _____ 16. A _____ seam requires no bending.
A. lap C. double
B. grooved D. standing
- _____ 17. Steel _____ and bars are used when maximum strength is required.
A. angles C. sheets
B. wires D. neither A, B, nor C
- _____ 18. _____ molds are used on a brake to create curved shapes such as cornices.

T F 19. A wired edge wraps sheet metal around wire for increased strength.

_____ 20. A _____ clip is sometimes called a pocket lock.

A. drive

B. government

C. flange

D. A, B, and C

Matching – Seams

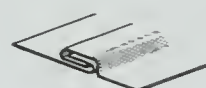
- _____ 1. Insert bottom
- _____ 2. Grooved
- _____ 3. Lap
- _____ 4. Standing
- _____ 5. Cap strip
- _____ 6. Riveted or soldered
- _____ 7. Single bottom
- _____ 8. Lap bottom
- _____ 9. Plain dovetail
- _____ 10. Flange dovetail
- _____ 11. Bottom double
- _____ 12. Elbow
- _____ 13. Pittsburgh lock
- _____ 14. Corner double
- _____ 15. Beaded dovetail
- _____ 16. Reversible elbow



(A)



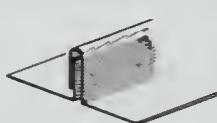
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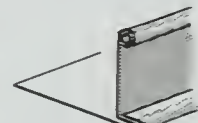
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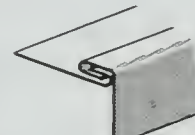
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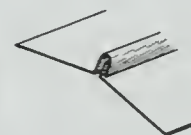
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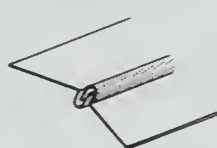
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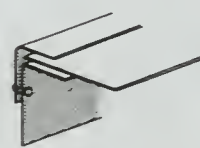
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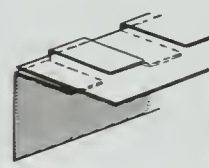
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(O)



(P)

Matching – Edges

- _____ 1. Capped
- _____ 2. Band iron
- _____ 3. Hem
- _____ 4. Angle iron
- _____ 5. Wired
- _____ 6. Blind
- _____ 7. Double hem



(A)



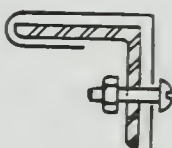
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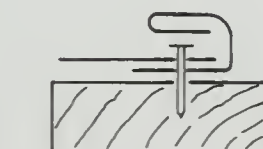
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(F)



(G)



TEST 10

Name _____ Date _____

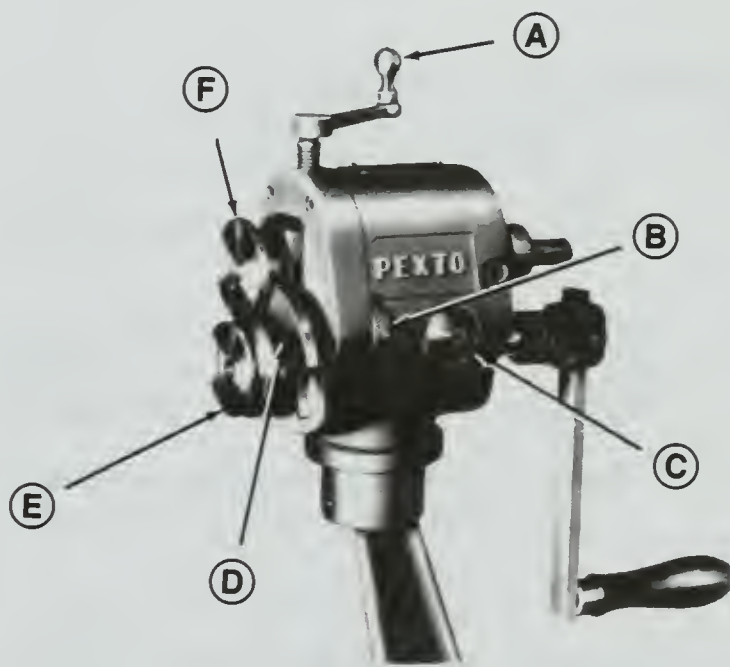
Turning, Burring and Raising

- _____ 1. Burred edges are usually _____" or less.
- T F 2. The main difference between the turning machine and the burring machine is the profile of the forming rolls.
- _____ 3. _____ machines have interchangeable rolls for different operations.
- _____ 4. A(n) _____ machine uses lighter metal fittings which require sharply-angled flanges.
- T F 5. On a wired edge, the distance from the gage to the center of the working radius of the upper roll is four times the diameter of the wire.
- T F 6. Elbow edges are prepared the same as turned edges except that special rolls are used.
- T F 7. When turning a wired edge, the crank screw is tightened so the rolls pull the work through.
- _____ 8. The rolls on a combination machine are changed by using _____.
A. slip-joint pliers C. flat-nose pliers
B. a spanner wrench D. neither A, B, nor C
- T F 9. Raising is the process of raising or bumping flat metal.
- T F 10. Raising blocks are commonly made from hardwood.
- _____ 11. Two types of rotary machines are the turning machine and the _____ machine.
- T F 12. When raising, the work is gradually turned as each blow is struck.
- _____ 13. The upper roll of a burring machine has a(n) _____ edge.
- _____ 14. The _____ machine is used for bending sharp angles on heavier gage sheet metal.
- _____ 15. The _____ machine is generally used to turn small edges on circular disks for pail covers and bottoms.
- T F 16. When raising, work progresses from the center to the outside.
- T F 17. Raising hammers are available in different face sizes depending on the size and depth of the depression required.
- _____ 18. _____ rolls are used in the first step of making a wired edge.
- _____ 19. A(n) _____ is used with a teakettle stake to smooth out wrinkles in the raising process.
- T F 20. Wire is inserted in the sheet metal when using turning rolls to make a wired edge.
- _____ 21. The _____ is turned to increase pressure on the sheet metal between the turning rolls.

- _____ 22. _____ rolls are used to make an elbow edge.
- | | |
|------------|------------------------|
| A. Forming | C. Angular |
| B. Burring | D. neither A, B, nor C |

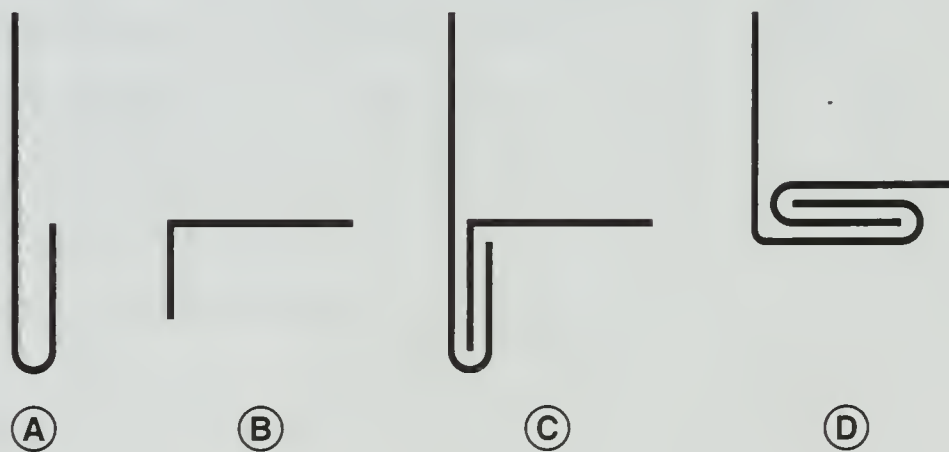
Matching – Rotary Machine

- | | |
|-------|--------------------|
| _____ | 1. Gage lock |
| _____ | 2. Upper roll |
| _____ | 3. Gage |
| _____ | 4. Gage adjustment |
| _____ | 5. Crank screw |
| _____ | 6. Lower roll |



Matching – Seaming

- | | |
|-------|-------------------------|
| _____ | 1. Burred edge |
| _____ | 2. Turned edge |
| _____ | 3. Finished double seam |
| _____ | 4. Finished single seam |





TEST 11

Name _____ Date _____

Forming, Crimping, Beading and Grooving

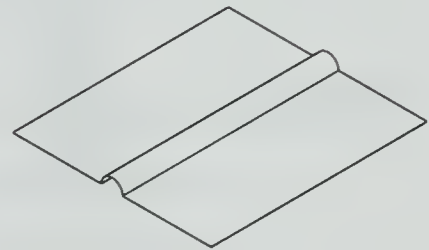
- _____ 1. The plain forming machine consists of _____ rollers.
- _____ 2. The rear roll, or _____ roll, is adjustable to accommodate different thicknesses.
- T F 3. Cylinders with wired edges are formed using beading and crimping rolls.
- T F 4. The clearance between the front rolls of a forming machine is adjusted to prevent smashing the locks flat.
- T F 5. When forming a cylinder with a wired edge, the wire is extended past the metal on each end.
- T F 6. Crimping is the process of corrugating one end of a pipe to fit into another pipe.
- T F 7. Crimping is done on light gage metal only.
- _____ 8. Standard bead shapes commonly used are the single bead, ogee bead, and _____ bead.
- T F 9. Crimping and beading operations must be done separately.
- _____ 10. Beads formed on cylindrical objects serve as _____, reinforcement, or ornamentation.
- T F 11. Excessive tightening of the crankscrew during beading can cause the rolls to cut through the bead.
- _____ 12. The _____ roll on a slip-roll forming machine can be released and swung away for removal of the formed metal.
A. idler C. upper front
B. lower front D. neither A, B, nor C
- T F 13. When forming cylinders, the radius of the cylinder is controlled by the position of the lower front roll.
- T F 14. Work is removed by passing it completely through on a plain forming machine.
- _____ 15. On forming machines, the two front rolls act as _____ or gripping rolls.
- _____ 16. Grooves in the rolls of a forming machine allow forming pieces with _____ edges.
A. crimped C. dovetailed
B. wired D. A, B, and C
- T F 17. Beading machines are hand operated or power driven.
- T F 18. A revolving tool stand holds four machines that can be rotated for different machine operations.
- _____ 19. A dovetail seam is used to join a round pipe to a(n) _____ plate.

- _____ 20. Two forming machine types commonly used in the sheet metal shop are the plain forming machine and the _____ forming machine.
- _____ 21. Every other _____ on the pipe is bent when making a dovetail seam.
- _____ 22. A bending machine with a deep throat allows beading several inches from the _____ of the cylinder.
- T F 23. The forming process is begun by inserting the work between the front and idler rolls.
- _____ 24. A(n) _____ gage made from scrap sheet metal can be used to mark for seam allowances on a dovetail seam.
- _____ 25. _____ screws on the front of the slip-roll former control the distance between the two front rolls.

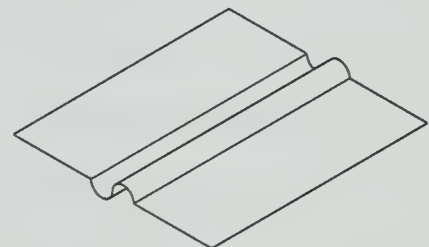
Matching – Beads

- _____ 1. Single bead
- _____ 2. Ogee bead
- _____ 3. Triple bead

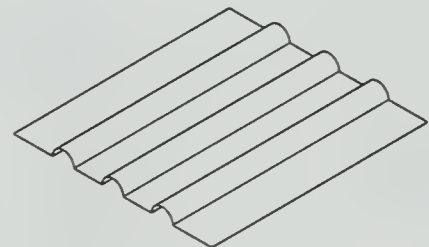
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TEST 12

Name _____ Date _____

Soldering

- _____ 1. Hard soldering uses solder with a melting point over _____ °F.
- T F 2. A 60-40 solder contains 40% tin.
- T F 3. Increasing the amount of lead in solder lowers the melting point.
- T F 4. Muriatic acid is an ingredient in the flux used on galvanized steel.
- _____ 5. Solder is commonly used in bar or _____ form.
- T F 6. Soldering coppers are made of zinc-coated steel.
- _____ 7. A soldering copper marked with a number 4 weighs _____ lb without a handle or shank.
- T F 8. Electric bench furnaces are used to heat soldering coppers.
- T F 9. Soldering copper handles are commonly made of wood.
- T F 10. Roofing and other heavy soldering operations commonly use 12 lb and 16 lb soldering coppers.
- _____ 11. _____ is applied before soldering to remove any oxide film on the metal.
- A. Flux C. Tin
B. Lead D. A, B, and C
- _____ 12. _____ is the process of covering the soldering copper point with solder.
- _____ 13. A(n) _____ seam has solder completely fill the joint.
- T F 14. Soldering coppers are heated until red before tinning.
- T F 15. The soldering copper must be tinned on all sides when soldering vertical seams.
- _____ 16. _____ chloride is an ingredient in the flux used on brass, copper, and lead.
- A. Lead C. Zinc
B. Copper D. A, B, and C
- _____ 17. Melting drops of solder along a lap seam to hold it in place is called _____.
A. pointing C. curing
B. sweating D. tacking
- _____ 18. _____ core solder has a non-corrosive flux in the center from the manufacturer.
- A. Acid C. Rosin
B. Zinc D. Muriatic
- _____ 19. Rosin used as a flux is applied as a _____.
A. powder C. both A and B
B. paste D. neither A nor B

- _____ 20. _____ is a term used to describe soldering vertical seams.
A. Skimming C. Pointing up
B. Dipping D. neither A, B, nor C
- T F 21. Eye protection must be worn when working with acids used to make flux.
- T F 22. Acid fluxes used in the soldering operation should be allowed to cure for 24 hours before removal.
- _____ 23. The most common solder used in sheet metal shops is _____ solder.
A. 40-60 C. 60-40
B. 50-50 D. neither A, B, nor C
- _____ 24. The percentage of _____ content is always given first when specifying solder.
A. tin C. lead
B. zinc D. copper
- _____ 25. Solder is available as _____.
A. $\frac{1}{16}$ " wire C. $\frac{1}{2}$ pound bars
B. round bars D. A, B, and C
- _____ 26. Soldering processes above 750°F include silver soldering and _____.
- T F 27. Soldering refers to joining two or more pieces using an alloy with a higher melting point than the pieces joined.
- T F 28. The size of soldering coppers is specified by weight per pair.
- _____ 29. Liquid fluxes are applied with a(n) _____ or swab.
- _____ 30. Solder with a 50-50 composition has a melting temperature of approximately _____ °F.
A. 312 C. 573
B. 418 D. 750
- T F 31. Soldering seams over a piece of steel may cause a loss of heat resulting in a weak soldered joint.
- _____ 32. Soldering coppers are _____ to remove pits and old tinning.
- _____ 33. Powdered _____ is mixed with water for use as a dipping solution.
- T F 34. Raw acid is never used as a flux for soldering copper.
- _____ 35. _____ is a soldering method in which the solder only covers the surface of the seam.
A. Pointing C. Skimming
B. Sweating D. Fluxing



TEST 13

Name _____ Date _____

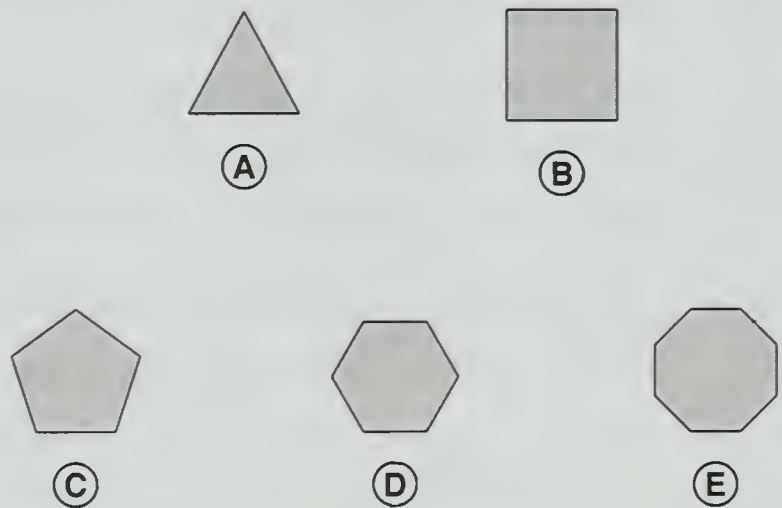
Drawing for Pattern Drafting

- T F 1. Templates are patterns that are used repeatedly.
- T F 2. A T-square is a drafting tool used to draw horizontal lines.
- T F 3. A straight line is the shortest distance between two points.
- T F 4. A perpendicular line is at a right angle to a given line.
- T F 5. The apex is the point of intersection of the sides of an angle.
- T F 6. An obtuse angle is less than a right angle.
- T F 7. An obtuse-angle triangle has two acute angles.
- T F 8. Each of the two points on an ellipse is called an axis.
- T F 9. The apex of a right cone is centered above the base.
- T F 10. Solid geometric figures have three dimensions; length, breadth, and height.
- T F 11. The frustum of a cone is that portion between the base and a plane parallel to the base.
- T F 12. The triangular faces of a pyramid meet at a point called the apex.
- T F 13. French curves are used to draw irregular curves.
- _____ 14. A(n) _____ cone is a cone having the apex off center to the base.
- T F 15. Triangles commonly used for drawing sheet metal patterns are the 30°-60° and the 45°.
- _____ 16. The _____ of a circle is a straight line drawn from the center to any part on the circumference.
- T F 17. The major axis is longer than the minor axis in an ellipse.
- _____ 18. _____ angles are less than 90°.
- _____ 19. _____ lines are used to show the axes of symmetrical parts.
A. Center C. Hidden
B. Oblique D. Obtuse
- T F 20. Parallel lines are equally distant at any point.
- _____ 21. A(n) _____ is a straight line of unlimited length that touches the circumference of a circle at one point.
- _____ 22. A(n) _____ has five sides.
- _____ 23. A(n) _____ is any part of the circumference of a circle.

- _____ 24. Dimension and _____ lines are used with figures to show the sizes of objects.
- _____ 25. Protractors are used to construct _____.
- _____ 26. A(n) _____ is a solid geometric figure having a circular base and a curved surface joining at a point called the apex.
- _____ 27. A(n) _____ has six sides.
- _____ 28. A(n) _____ is a plane figure bounded by a curved line called the circumference.
- _____ 29. _____ lines are perpendicular to the horizon.
- A. Obtuse
B. Vertical
C. Vertex
D. neither A, B, nor C
- _____ 30. The _____ of a circle is a straight line drawn through the center to opposite points on the circumference.
- A. radius
B. tangent
C. chord
D. diameter
- _____ 31. _____ lines are parallel to the horizon.
- _____ 32. A(n) _____ line is a line in which the direction is continually changing.

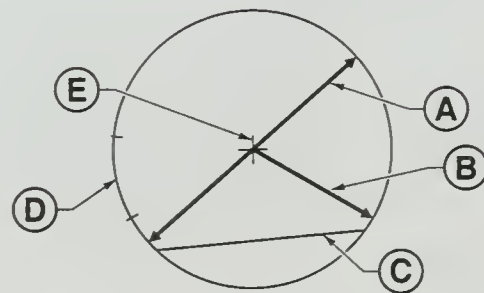
Matching – Polygons

- _____ 1. Hexagon
- _____ 2. Square
- _____ 3. Pentagon
- _____ 4. Triangle
- _____ 5. Octagon



Matching – Circle Parts

- _____ 1. Centerpoint
- _____ 2. Chord
- _____ 3. Diameter
- _____ 4. Radius
- _____ 5. Arc





TEST 14

Name _____ Date _____

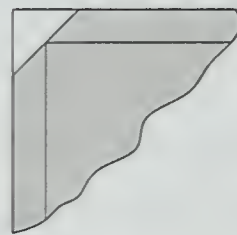
Making and Notching Simple Patterns

- _____ 1. Layouts that require no advanced drafting knowledge are known as _____ patterns.
- _____ 2. Bowing or _____ in the sheet metal affects accuracy in layout.
- _____ 3. A(n) _____ notch used on boxes and pans provides clearance for corners to fit together.
- T F 4. The sheet metal pattern is developed from the lower left-hand corner of the sheet.
- T F 5. Straight notches are used on inside flanges and double seams.
- _____ 6. The pattern is _____ at a 45° angle to allow for clearance on single hems.
- T F 7. A straight notch requires a 60° angle.
- T F 8. Measurements are taken from the bottom and left-hand square line when starting the layout.
- _____ 9. The angle of a notch where wired edges cross seams is usually _____ $^\circ$.
- T F 10. Sheet metal should be cut to final size before laying out the pattern.
- T F 11. The size of a square notch is determined by the bend lines on the layout.
- T F 12. Vertical and horizontal lines are drawn on the pattern before lines for notches, seams, and edges.
- _____ 13. Laps on a box can be joined by _____.
A. spot welding C. soldering
B. riveting D. A, B, and C
- T F 14. The length of round pipe is commonly joined with a groove seam.
- T F 15. All lines of the pattern are drawn before starting to cut out the pattern.
- T F 16. Sheet metal is rarely square from the manufacturer.
- _____ 17. A _____ notch is used when double seaming the ends of pans.
A. straight C. wired edge
B. square D. neither A, B, nor C
- _____ 18. The notch is started _____ times the diameter of the wire from the notch angle in a wired edge.
A. $1\frac{1}{2}$ C. 3
B. $2\frac{1}{2}$ D. $3\frac{1}{2}$
- _____ 19. Parallel lines in a layout should not vary more than _____".
A. $\frac{1}{32}$ C. $\frac{1}{8}$
B. $\frac{1}{16}$ D. $\frac{1}{4}$

- T F 20. Clipping requires cutting an angle through the fold lines of the layout.
- _____ 21. _____ seams are commonly used for joining the length of a one-piece duct.
- T F 22. Two heel patterns are required for a rectangular duct elbow.
- _____ 23. Bend lines are marked with a prick punch approximately _____" from the end of the line.
- _____ 24. A _____ notch requires one cut on the same line as the bend line.
 A. straight C. wired edge
 B. square D. 45°
- T F 25. Marks made with the prick punch can be used to lay out lines on both sides of the sheet metal.

Matching – Notching and Clipping

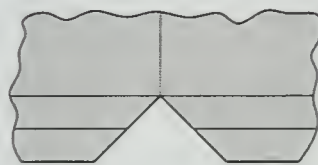
- _____ 1. Square notch
- _____ 2. 45° notch
- _____ 3. Straight notch
- _____ 4. Clipping



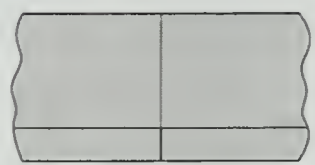
(A)



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(C)



(D)



TEST 15

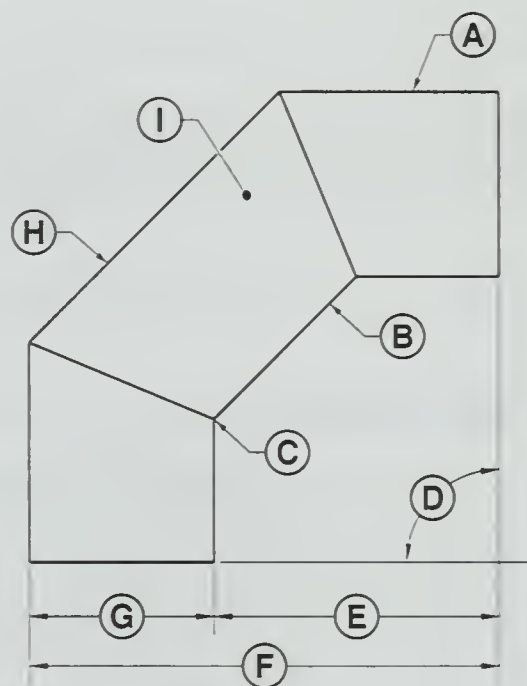
Name _____ Date _____

Parallel Line Development

- _____ 1. The sides run parallel to one another in _____ line developments.
- _____ 2. Intersecting pipes are called _____.
- _____ 3. A(n) _____ is the shape of the fitting at that particular point.
- _____ 4. A(n) _____ line is the intersection line of two pipes.
- T F 5. The layout of the hole pattern for a round tee is made using parallel lines.
- _____ 6. The inside radius of an elbow is called the _____ radius.
- _____ 7. Sections of an elbow are called _____.
A. miters C. profiles
B. seams D. gores
- _____ 8. The curve of a miter for a round pipe can be drawn _____.
A. freehand C. with a drawing curve
B. with a flexible rule D. A, B, and C
- _____ 9. The _____ gore is an exact duplicate of the two end gores.
- T F 10. The pattern for the first gore is laid out before the miter lines are located.
- _____ 11. All round pipe must be laid out using _____ line development.
- _____ 12. The number of spaces for a 4-piece round elbow is _____.
A. two C. six
B. four D. eight
- T F 13. The heel radius is greater than the throat radius.
- T F 14. Alternating the seam sides of each gore in a round elbow is a standard practice.
- _____ 15. The heel radius is equal to the throat radius plus the pipe _____.
A. miter lines C. end gore
B. diameter D. throat

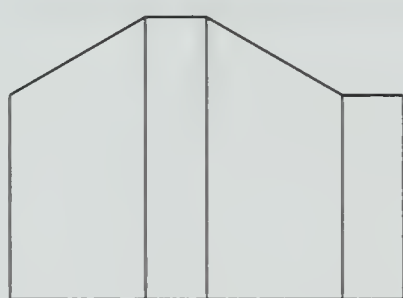
Matching – Three-Piece Elbow

- _____ 1. Throat radius
- _____ 2. Diameter
- _____ 3. End gore
- _____ 4. Angle
- _____ 5. Heel
- _____ 6. Heel radius
- _____ 7. Throat
- _____ 8. Miter lines
- _____ 9. Middle gore

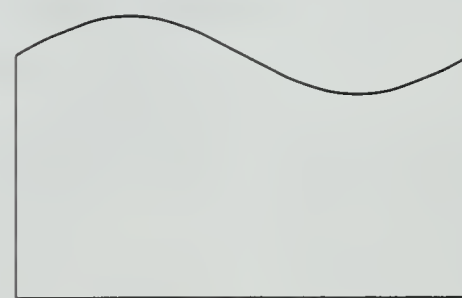


Matching – Patterns

- _____ 1. Plain rectangular duct
- _____ 2. Rectangular duct with miter
- _____ 3. Round pipe with miter
- _____ 4. Round pipe with double angle



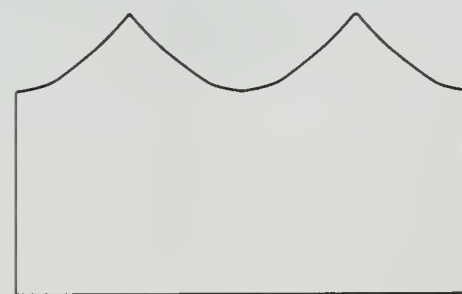
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(D)



TEST 16

Name _____ Date _____

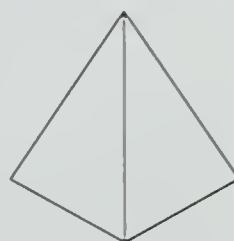
Triangulation

- _____ 1. _____ is working from two known points to locate a third point.
- _____ 2. Lines perpendicular to the viewer's line of vision are _____.
- _____ 3. A(n) _____ surface is a surface having length and width, or two dimensions.
- _____ 4. In a(n) _____ view, all lines in a vertical plane are true lengths.
A. elevation C. oblique
B. plan D. neither A, B, nor C
- _____ 5. The horizontal plane has its surface level with the _____.
- T F 6. The triangulation method requires drawing triangles on the pattern one at a time.
- _____ 7. Patterns for _____ are laid out by triangulation.
A. square tapers C. transitional duct fittings
B. round tapers D. A, B, and C
- T F 8. True length measurements are shown on the hypotenuse of a true length triangle.
- T F 9. The plan and elevation views are constructed after true lengths are determined.
- _____ 10. A(n) _____ plane has its surface at right angles or perpendicular to the horizontal plane.
- T F 11. A straight line, by its definition, must lie on a plane surface.
- _____ 12. All lines in the _____ plane are true length in the plan view.
- T F 13. All lines shown on the elevation view are true lengths.
- _____ 14. A slanted or _____ plane has its surface at any angle between the vertical and horizontal planes.
- T F 15. The surfaces of the fitting are laid out with true lengths when developing a pattern using the triangulation method.
- _____ 16. Plane surfaces may be _____.
A. horizontal C. slanted
B. vertical D. A, B, and C
- T F 17. To lay out a round taper, measuring lines are established on the plan view.
- _____ 18. Only one-half of the pattern is developed if the fitting is _____.
A. tapered C. symmetrical
B. triangular D. A, B, and C
- T F 19. Drawing instruments are commonly used to lay out the pattern after true lengths are found.

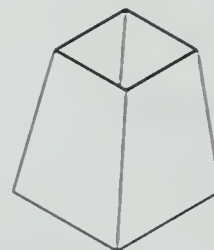
- T F 20. Dimensions from the plan view provide enough information to create a true length triangle.

Matching – Fittings

- _____ 1. Offset and transitional duct fittings
 _____ 2. Round taper
 _____ 3. Pyramid
 _____ 4. Square taper
 _____ 5. Shape transitional fittings



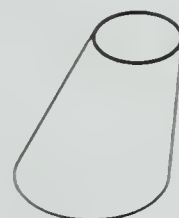
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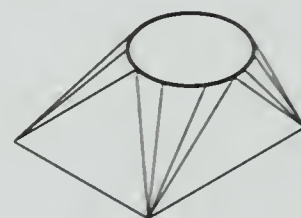
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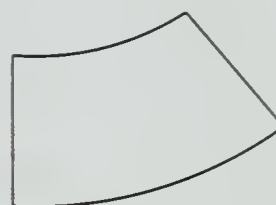
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Matching – Triangulation Patterns

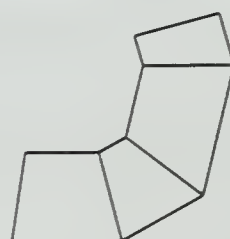
- _____ 1. Rectangular transition
 _____ 2. Offset round taper
 _____ 3. Oval-to-round fitting
 _____ 4. Square-to-round fitting



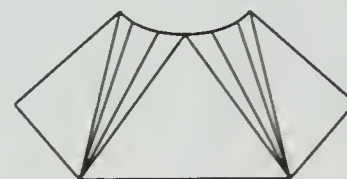
(A)



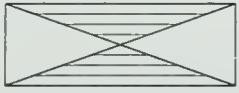
(B)



(C)



(D)



TEST 17

Name _____ Date _____

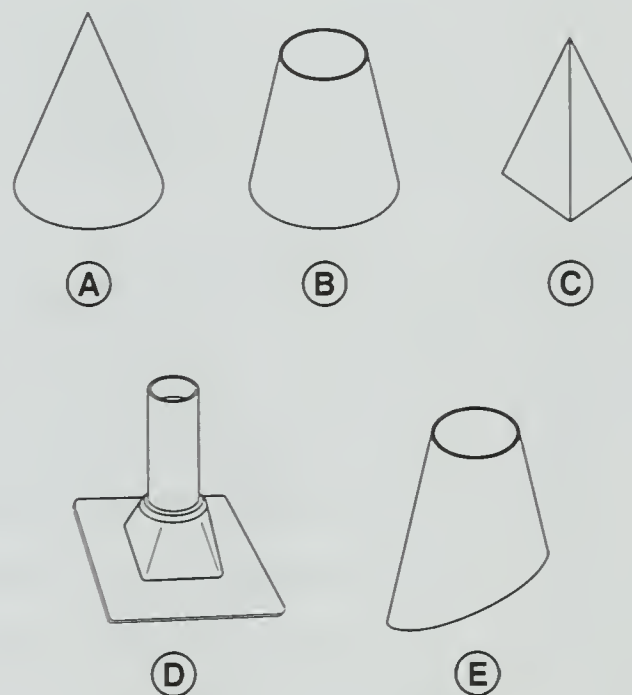
Radial Line Development

- _____ 1. All lines must radiate from a common _____ for radial line development to be used.
- T F 2. Radial line development is faster than triangulation on some objects.
- _____ 3. Radial line development is used for _____ patterns.
A. elbow C. square duct
B. cone D. A, B, and C
- _____ 4. The height of the apex of a cone is shown in the _____ view.
- _____ 5. The _____ arc of the cone is drawn with a radius equal to the true length of the side.
- T F 6. Radial line development has many similarities to parallel line development.
- T F 7. Objects must be centered and equally tapered on all sides to use radial line development.
- T F 8. The stretchout arc is swung half the stretchout diameter when developing a cone pattern.
- T F 9. Patterns for truncated right cones are developed using radial line development.
- _____ 10. Equally spaced _____ lines are drawn when laying out a round taper with a pitch.
A. miter C. extension
B. tapering D. parallel
- T F 11. "Object on pitch" means one or both fitting ends are slanted rather than square to the center line.
- T F 12. Radial line development can be used on simple fittings only.
- _____ 13. _____ with rectangular bases and equally tapered sides can be laid out by radial line development.
- _____ 14. The _____ view is drawn first when laying out a centered round taper.
- _____ 15. The _____ is used as the center to swing arcs from the top and bottom corners of the taper.
A. heel C. throat
B. apex D. vertex
- T F 16. The circumference of a cone diameter is determined with parallel line measurements.
- T F 17. All round tapers can be laid out by radial line development.
- _____ 18. The _____ of the bottom of a cone is determined mathematically.
- _____ 19. A centered round taper is the same as a(n) _____ with the top cut off.
- T F 20. The radius for a cone stretchout arc is given in the elevation view.

- T F 21. The cone stretchout arc is developed before the apex is located.
- T F 22. All points around the bottom circumference are equidistant from the apex in a cone.
- T F 23. Triangulation is used to determine true lengths in round tapers.
- T F 24. The half plan circumference of a cone is equal to half of the stretchout arc.
- _____ 25. Most radial line developments begin with drawing the _____ view.

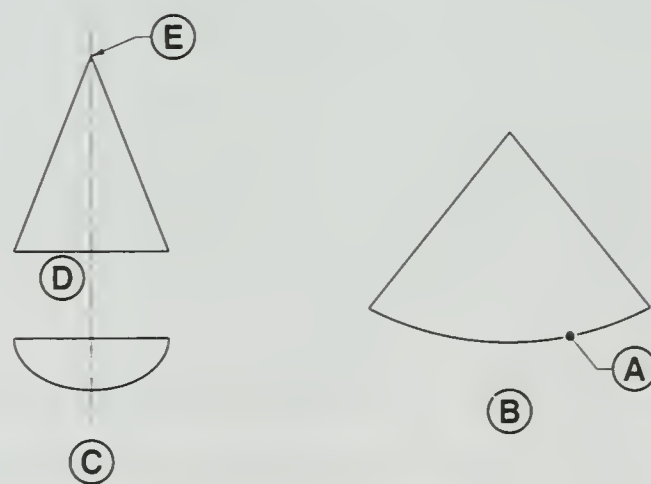
Matching – Radial Development Fittings and Shapes

- _____ 1. Roof jack
- _____ 2. Round taper with end on slant
- _____ 3. Cone
- _____ 4. Square and rectangular pyramid
- _____ 5. Funnel and taper



Matching – Radial Line Development

- _____ 1. Pattern
- _____ 2. Stretchout arc
- _____ 3. Apex
- _____ 4. Half plan
- _____ 5. Elevation





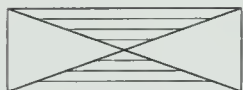
TEST 18

Name _____ Date _____

Sheet Metal in the Building Trades

- T F 1. Duct and duct fittings are commonly fabricated from galvanized sheet steel.
- T F 2. Working drawings specify the shape, size, and location of components required in the structure.
- _____ 3. _____ are written instructions that cannot be conveniently shown on the working drawings.
- T F 4. Details are commonly identified with the detail number and the shop drawing number.
- T F 5. Labels are attached to each duct fitting at the job site.
- _____ 6. _____ on working drawings are a plan or section view drawn at a larger scale.
- _____ 7. The fabrication and installation of _____ is the most common task of sheet metal workers.
A. gutters C. flashing
B. structural steel D. ductwork
- _____ 8. Mechanical plans provide information about the size of _____ in the HVAC system.
- _____ 9. A(n) _____ is a statement binding the contractor to a certain quality of work over a specified period of time.
- _____ 10. Specifications follow the standardized format developed by the _____.
A. engineer C. Construction Specifications Institute
B. sheet metal worker D. neither A, B, nor C
- _____ 11. Elevations specified on a shop drawing are generally the distance from the finished floor to the _____ of the duct.
- T F 12. Each craft "signs off" on the shop drawing to indicate approval.
- _____ 13. A(n) _____ is a duct fitting used when a double curve is required.
A. degree elbow C. S offset
B. transition D. neither A, B, nor C
- T F 14. Flex duct is available in 4" to 16" diameters.
- _____ 15. A _____ is a duct fitting used to change the direction of ductwork 90°.
A. degree elbow C. transition
B. taper D. neither A, B, nor C
- _____ 16. Working drawings commonly contain _____.
A. a Title sheet C. Civil drawings
B. Architectural drawings D. A, B, and C

- _____ 17. _____ are used on prints to indicate the materials and duct fittings used at each location.
 A. Details C. Codes
 B. Provisions D. Symbols
- _____ 18. Sheet metal most commonly used for ductwork is 24 to _____ gauge.
- _____ 19. _____ provides better insulation and sound deadening characteristics than sheet metal.
- _____ 20. _____ duct is flexible, round duct that can be bent into several angles.
 A. Spiral C. Flex
 B. Rigid D. neither A, B, nor C
- _____ 21. Spiral duct is available in diameters from 3" to _____".
 A. 24 C. 48
 B. 36 D. 60
- _____ 22. _____ elbows are the most commonly used.
 A. Square throat C. Curved throat
 B. Curved transition D. Transition degree
- T F 23. Traditional layout and fabrication methods create duct fittings using computers and forming equipment.
- _____ 24. A(n) _____ is an accurate, detailed drawing used to lay out and fabricate all duct and duct fittings on a job.
- T F 25. Symbols used in prints are commonly listed on the first sheet of each section of the working drawings.
- _____ 26. A slanted cheek in an elbow is laid out using _____.
 A. triangulation C. radial line development
 B. parallel line development D. A, B, and C
- T F 27. In computerized layout and fabrication, data is saved to disk or is sent to a remote location by modem.
- _____ 28. _____ elbows change the duct size in the elbow.
- _____ 29. A(n) _____ is a duct fitting used to change duct size without changing the direction.
 A. degree elbow C. S offset
 B. transition D. neither A, B, nor C
- _____ 30. A(n) _____ lists duct fitting specifications used in the fabrication.
- T F 31. Both cheeks on a transition in heel and throat elbow require the same pattern.
- _____ 32. The _____ drawing is checked with electrical, structural steel, and other plans to identify possible problem areas.
- _____ 33. An S offset with a transition in cheek is laid out using two _____.
- T F 34. Numbers on the working drawing correspond to each duct and duct fitting.
- _____ 35. The _____ includes the number and sizes of pieces required for each pattern specified on the shop ticket.
- _____ 36. An elbow can change size in the cheek, heel, or _____.



TEST 19

Name _____ Date _____

Short Method of Pattern Development

- _____ 1. _____ is another name for the short method of pattern development.
- _____ 2. Patterns developed using the short method do not include allowance for _____ or soldering.
- T F 3. The short method can be used with objects that are not symmetrical.
- T F 4. The short method can use more than one template.
- T F 5. A template is not required on off-center patterns using the short method.
- _____ 6. The short method uses a _____ pattern to create the template.
A. full C. triangulated
B. half D. neither A, B, nor C
- T F 7. Templates for larger patterns are made from heavier gage metal.
- _____ 8. The _____ of the pattern must be bent accurately to produce the correct pattern.
- T F 9. Bends for complex templates must be clearly marked to prevent mistakes on the pattern.
- T F 10. A pattern holder is made from 30 gage sheet metal.
- _____ 11. The pattern is transferred from the template using _____.
A. chalk C. pencil marks
B. oil D. A, B, and C
- _____ 12. Marks in the pattern can be drawn into a smooth curve using a(n) _____ rule.
- _____ 13. The height of the template is determined by the _____ view.
- T F 14. The short method should be used as a supplementary method to other pattern development methods.
- T F 15. The template for a funnel includes half of the circumference when using the short method.
- _____ 16. The top and bottom profiles are bent _____° on a funnel template using the short method.
- T F 17. Complex patterns may have more than two bends on the template.
- _____ 18. A template holder should be made from _____ gage or thicker sheet metal.
- T F 19. The short method can be used for developing a pattern for square-to-round fittings.
- T F 20. The template is rolled out twice on a flat surface to obtain a full pattern of a funnel.
- T F 21. The template is rolled slowly when transferring a pattern.

- T F 22. The short method allows for hem dimensions.
- T F 23. The curved edges of the template transfer the funnel pattern.
- T F 24. The bottom profile is not required for symmetrical shapes using the short method.
- T F 25. Templates developed using the short method are commonly made from paper.

Matching – Short Method Patterns

- _____ 1. Square-to-round fitting
- _____ 2. Offcenter oval-to-round fitting
- _____ 3. Y fitting
- _____ 4. Square-to-rectangular fitting



(A)



(B)



(C)



(D)



FINAL EXAM

Name _____ Date _____

- T F 1. A sheet metal fabricator is often the person who lays out the patterns.

2. The term sheet metal generally applies to metals and alloys ranging in thickness up to _____ gage.

3. The Joint Apprenticeship and Training Committee is composed of _____.
A. apprentices C. journeyman sheet metal workers
B. sheet metal employers D. sheet metal workers and employers
- T F 4. Workers in the sheet metal industry commonly fabricate and install gutters, sheet metal roofs, and ductwork.
- T F 5. An Apprenticeship Agreement is an agreement between the apprentice and the employer.

6. Apprenticeship programs for sheet metal workers last approximately _____.
A. six months C. two years
B. one year D. four to five years
- T F 7. A steel square is commonly used to transfer layouts.

8. A steel _____ rule is used for finding the circumference of a circle or cylinder.

9. _____ punches have a point that is tapered to a 30° included angle.
A. Prick C. Solid
B. Center D. Hollow
10. _____ are used when steel hammers would damage the work.
A. Ball peen hammers C. Riveting hammers
B. Setting hammers D. Mallets
11. A(n) _____ chisel is used to cut V-shaped grooves.

- T F 12. A crimping machine is used for grooving longitudinal seams in cylinders.
- T F 13. Aviation snips use compound leverage to cut thick sheet metal.
14. Press brakes shape sheet metal with pressure between the _____.

15. _____ in galvanized sheet metal gives off toxic fumes when welded.

16. _____ are small, curved slivers of metal left on the edges of sheet metal after cutting.
A. Extensions C. Cutoffs
B. Hems D. neither A, B, nor C
- T F 17. Power tools must be properly grounded to prevent injury from electric shock.

- T F 39. A 10-32 machine screw has UNF threads.
- _____ 40. The size of _____ rivets are determined by the approximate weight per thousand rivets.
A. standard C. blind
B. countersunk head D. tinner's
- _____ 41. A(n) _____ is the distance across the flat pattern or flat piece of metal before it is formed.
- _____ 42. The circumference of a pipe is determined by multiplying _____ times the diameter.
- T F 43. The squaring shears should be operated with one foot.
- _____ 44. _____ are patterns used repeatedly.
- _____ 45. A(n) _____ is a power tool that cuts sheet metal by rapidly punching a small hole with each stroke.
- _____ 46. _____ refers to the method of developing lines that form a pattern.
A. Layout C. Notching
B. Clipping D. A, B, and C
- _____ 47. A(n) _____ uses gas directed through an electric arc to rapidly cut sheet metal.
- T F 48. An \times on a line of a pattern indicates the location of a bend.
- _____ 49. _____ is a layout method used to develop a pattern.
A. Simple pattern layout C. Parallel line development
B. Radial line development D. A, B, and C
- T F 50. A pictorial drawing shows the object after it is formed.
- T F 51. Twist drills can be sized by fractions.
- _____ 52. A(n) _____ is used to make an indentation for centering the drill.
- T F 53. A hand lever punch is used to punch holes in sheet metal by hand.
- _____ 54. _____ rivets have heads that are flat and flush with the metal after installation.
- _____ 55. The _____ seam is sometimes called a hammer lock, and is used as a longitudinal corner seam.
A. bottom C. Pittsburgh
B. grooved D. double
- T F 56. A single hem is used to increase strength and provide a finished edge.
- T F 57. A single bottom seam requires no bending.
- T F 58. The brake must be adjusted for different thicknesses of metal.
- _____ 59. A(n) _____ clip is sometimes called a pocket lock.
- _____ 60. A(n) _____ hem requires two folding operations.
- _____ 61. The most common seam used in the sheet metal shop is the _____ seam.

- _____ 62. _____ is the process of raising or bumping flat metal.
A. Burring C. Turning
B. Crimping D. Raising
- _____ 63. Turning rolls on a(n) _____ machine are used in the first step of making a wired edge.
- _____ 64. A(n) _____ former is used to form cylindrical shapes out of sheet metal.
- _____ 65. _____ is the process of corrugating one end of a pipe to fit into another pipe.
- _____ 66. _____ is applied before soldering to remove any oxide film on the metal.
- T F 67. Sweating is the process of covering the soldering copper point with solder.
- T F 68. The radius of a circle is a straight line drawn through the center to opposite points on the circumference.
- _____ 69. _____ angles are greater than a right angle.
A. Acute C. Obtuse
B. Perpendicular D. neither A, B, nor C
- _____ 70. A _____ is a solid geometric figure having a circular base and a curved surface joining at a point called the apex.
A. cone C. chord
B. pyramid D. cylinder
- T F 71. Clipping a single hem requires cutting a 45° angle.
- _____ 72. _____ are sections of an elbow.
- _____ 73. A(n) _____ line is the intersection line of two pipes.
- _____ 74. _____ is working from two known points to locate a third point.
A. Triangulation C. Parallel line development
B. Radial line development D. A, B, and C
- T F 75. All lines must radiate from a common center for radial line development.
- _____ 76. The fabrication and installation of _____ is the most common task of sheet metal workers.
- _____ 77. A(n) _____ is a duct fitting used to change the size of the duct without changing the direction.
A. elbow C. S offset
B. transition D. neither A, B, nor C
- _____ 78. _____ plans provide general information about the size of terminal devices in the HVAC system.
- T F 79. Sheet metal most commonly used for ductwork is 18 to 20 gage.
- _____ 80. Square throat elbows require turning _____ to direct air efficiently.

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